



CANADA

INSTITUT OcéANOGRAPHIQUE DE

~~~~~ BEDFORD ~~~~~

INSTITUTE OF OCEANOGRAPHY

DARTMOUTH, N. S.

FIRST ANNUAL REPORT

1962

B.I.O. 62-3

DECEMBER 1962

PROGRAMMED BY

THE CANADIAN COMMITTEE ON OCEANOGRAPHY

B E D F O R D   I N S T I T U T E   O F   O C E A N O G R A P H Y  
D A R T M O U T H ,   N . S .   -   C A N A D A

This is a technical report to our Headquarters which has received only limited circulation. On citing this report in a bibliography, the title should be followed by the words "UNPUBLISHED MANUSCRIPT" which is in accordance with accepted bibliographic custom.

F I R S T   A N N U A L   R E P O R T

1962

B . I . O .                      62-3

D E C E M B E R                1962

1962

FIRST ANNUAL REPORT

BEDFORD INSTITUTE OF OCEANOGRAPHY  
DEPARTMENT OF MINES AND TECHNICAL SURVEYS\*  
MARINE SCIENCES BRANCH

- 1) Foreword:
- 2) Acknowledgments:
- 3) Oceanographic Research Summaries :

|                            |                    |
|----------------------------|--------------------|
| Arctic Oceanography        | Mr. A.E. Collin    |
| Arctic Exploratory Surveys | Mr. A.M. Holler    |
|                            | Mr. J. Butters     |
| Deep Ocean Circulation     | Dr. C.R. Mann      |
| Air-Sea Interaction        | Dr. L.A.E. Doe     |
|                            | Mr. J.A. Coombs    |
| Chemical Service           | Mr. A.R. Coote     |
| Wave Recording             | Dr. R.L.G. Gilbert |
- 4) Technical Surveys-Summaries :

|                       |                  |
|-----------------------|------------------|
| Environmental Service | Mr. W.B. Bailey  |
| Tidal Current Surveys | Mr. D. Dobson    |
| Hydrographic Surveys  | Mr. G.W. LaCroix |
- 5) Areas of Operations-Diagrams :

|                        |
|------------------------|
| Oceanographic Research |
| Tidal Surveys          |
| Hydrographic Surveys   |
- 6) Directory of Professional and Senior Technical Staff:

\* The annual report of the Atlantic Oceanographic Group, Fisheries Research Board of Canada, will be distributed separately.

## FOREWORD:

"Oceanography" and "cooperation" are closely linked on both the national and international scene. In Canada, war-time cooperation was formalized in 1946 in the "Joint Committee on Oceanography". In 1959, this became the "Canadian Committee on Oceanography", composed of representatives of the federal agencies and Canadian universities concerned with the science of the sea.

The Bedford Institute of Oceanography, officially opened in October 1962, is a child of the Canadian Committee on Oceanography. It is a result of the Committee's decision, taken several years earlier, that oceanography in Canada must be expanded, to meet growing national needs, and that the federal department most appropriate for this expansion was the Department of Mines and Technical Surveys, with its marine interests in tidal studies and hydrographic surveys. The Fisheries Research Board agreed to house its nucleus of experienced oceanographers, the Atlantic Oceanographic Group, in the new Institute.

The Bedford Institute is Canada's centre for hydrography, oceanography, geophysics, chemistry and geology for the Atlantic and for most of the Canadian Arctic. In brief, it covers two activities: oceanographic research and technical surveys. These are being combined in one Institute -- the only example of its kind in North America - - in the

belief that their association will strengthen both of them in meeting Canada's needs for knowledge and understanding of the sea.

The Institute is designed for a total staff of 300 - - about half engineers and scientists - - and has dock space and support facilities for a fleet of 8 ships, including the 3,000-ton BAFFIN and the 4,500-ton HUDSON. A high level of electronic and mechanical design engineering support is planned. Modern digital computing and analysis facilities are being acquired to handle the masses of data necessary.

Progress in 1962 has been painful but steady and encouraging. On July 10 (just after the Canadian "austerity" measures were announced), 14 F.R.B. and 17 D.M. & T.S. staff moved into the still incompletd buildings. In mid-October, the hydrographic ships returned from their season's field work. On October 23, the Canadian Committee on Oceanography met in the Institute, its first meeting outside Ottawa.

The Institute was officially opened on October 25 by the Honourable Paul Martineau, Minister of Mines and Technical Surveys, following addresses by Mr. Martineau and by Dr. J. L. Kask, Chairman of the Fisheries Research Board. On that day, the Institute staff had risen to 95, and was host to over three hundred invited guests, including the Honourable

R. L. Stanfield, Premier of Nova Scotia, and representatives of science, industry, government and commerce from Canada and the United States. At year's end the staff in occupancy totals 110 and is expected to increase to 140 (16 F.R.B., 124 D.M. & T.S.) by the middle of 1963.

During 1962, the hydrographic survey and research vessels BAFFIN, KAPUSKASING, ACADIA and MAXWELL, which are attached to the Institute, supplemented by the chartered ships ARCTIC SEALER and NORTH STAR VI, spent a total of 660 days at sea and steamed 68,000 miles. Nearly all their time was spent on hydrographic surveys in the Atlantic and Arctic regions.

The main program of the Institute in its first year has naturally been carried over from projects initiated elsewhere. But as new staff has arrived, new proposals have been made and discussed, and some of them adopted. The technical surveys program has originated so far almost entirely in Ottawa. As our regional capability and staff are built up, this will become more and more a Bedford Institute responsibility. As a first step, a summary is being prepared of the surveys and charting which has been done or is underway in the Atlantic region. At the same time, an assessment has been started of the regional requirements for charting. This has been aided by a Fisheries Research Board survey of the chart needs of fishermen. In

these efforts, as in the setting up of a regional charting library and regional compilation facilities, we have been greatly aided by the cooperation of the Dominion Hydrographer and his staff in Ottawa.

In oceanographic research, the main work has been a continuation of two programs; the deep ocean circulation and Gulf of St. Lawrence studies made possible through the cooperation of the Fisheries Research Board; and a continuation of the exploratory surveys of Arctic waters, carried out from Department of Transport icebreakers. In June, D.M. & T.S. staff took over from F.R.B. staff the responsibility for provision of environmental information to the maritime defence forces. This important service requires much further development and expansion.

Plans for an expanded future program are well advanced. The Institute's submarine geology and marine geophysics programs will get underway in the spring of 1963. A small theoretical group will start work about the same time. A project to equip the Institute for Arctic ice-borne operations in the Arctic has begun, and an expanded program in Arctic oceanography and sea-ice physics is planned. The chemical oceanography program will be broadened to include radio-chemistry.

Further information on the research and survey program

carried out during 1962 will be found in the summaries of parts 3) and 4).

## 2) ACKNOWLEDGMENTS:

The Bedford Institute has been assisted through the difficult initial stage of its development by many individuals and agencies who have provided training for staff, laboratory and sea-going support, and facilities and assistance in the analysis of data. Our sincere thanks are extended to all the member agencies of the Canadian Committee on Oceanography and their units concerned, to the Committee members themselves, to scientific organizations in the Halifax area, and to our neighboring institutions and agencies in the United States of America, who have been most generous with their cooperation.



3) OCEANOGRAPHIC RESEARCH SUMMARIES:

A summary report on the oceanography of the network of shallow channels connecting the Arctic Ocean with Baffin Bay and Hudson Strait was prepared for presentation at the Arctic Institute's Hershey Symposium on "The Dynamics of the Arctic Basin Environment", October 8, 1962. It is available as manuscript report B.I.O. 62-2 "The Waters of the Canadian Archipelago" by A. E. Collin.

ARCTIC OCEANOGRAPHIC SURVEY -  
C.C.G.S. "LABRADOR" A. M. HOLLER

As in previous years, oceanographic surveys were carried out in the regions, using Department of Transport ice-breakers. The "LABRADOR" was assigned the following areas: Smith Sound, Jones Sound, Lancaster Sound, Baffin Bay and Davis Strait.

Purpose :

To observe conditions on stations occupied during the previous season, obtain information about the "flow" in Jones Sound and Lancaster Sound, occupy "Standard Stations" considered essential to ice-prediction studies carried out by the U.S. Navy Hydrographic Office and to collect biological samples for the Arctic Unit, F.R.B., Montreal.

Personnel:

The oceanographic party consisted of two members of the B.I.O. staff, who joined the vessel at Thule on September 24th. Four seasonal employees of the Canadian Hydrographic Service assisted in the work.

Observations :

These consisted of Bathythermograph lowerings - temperature and salinity measurements at standard depths to near bottom on all stations. Oxygen analysis, vertical plankton hauls and bottom sampling were carried out at selected stations. Observations commenced on September 25

and were completed on October 20. The stations positions are shown on the track chart. The work accomplished is summarized in the following table :

|                                  |      |
|----------------------------------|------|
| Oceanographic Stations occupied  | 81   |
| Additional Bathythermograph Obs. | 9    |
| Salinities                       | 1075 |
| Oxygen samples analyzed          | 4.7  |
| Plankton (inc. 7 deep hauls)     | 28   |
| Microplankton                    | 128  |
| Bottom samples (Benthos)         | 15   |

Observations were begun in Smith Sound - N. Baffin Bay areas with 11 stations occupied in these regions, followed by 12 stations in the eastern end of Jones Sound and 22 stations across Lancaster Sound. The remainder (36 stations) were located in Baffin Bay/Davis Strait. Locations are shown in the accompanying diagram.

Standard Stations :

Considering the ice prediction studies and the reversal of the heat budget these stations were occupied after October 1. The observed temperatures and profiles of the upper 500 metres for 21 stations were forwarded to the U. S. Navy Hydrographic Office.

Biological Sampling :

All benthos or plankton and microplankton samples were forwarded to the Arctic Unit, F. R. B., Montreal.

Salinities are to be determined at B.I.O. on the  
N. I. O. salinometer.

ARCTIC OCEANOGRAPHIC SURVEY -  
C.C.G.S. "JOHN A. MACDONALD" J. BUTTERS

Through the courtesy of the Marine Branch of the Department of Transport, the Canadian Icebreaker "JOHN A. MACDONALD" was again made available for oceanographic and hydrographic observation in the Arctic Archipelago. The ultimate aim of the cruise is contained in the cruise memorandum below, which was the basis for the programme actually put into effect.

- a) The Tanquary Fiord operation and the Sherwood Head exercise.
- b) A joint Oceanographic-Hydrographic survey of McLure Strait, Viscount Melville Sound, M'Clintock Channel and Peel Sound, to study the physical oceanographic properties of those waters and to obtain an acceptable picture of the bathymetry.
- c) Oceanographic observations in the Hudson Bay and Strait.

During the unloading operation in Tanquary Fiord at 81°24' N., a hydrographic survey was made down to McKinley Bay, and oceanographic stations were occupied.

The probe into Nansen Sound was halted by polar ice at 81°13' N., 91°15' W.

Leaving Eureka Sound the ship proceeded south through Norwegian Bay and Belcher Channel, and out by way of

Penny Strait. Proceeding through Viscount Melville Sound, a hydrographic-oceanographic survey was made in M'Clure Strait to a line 121°00' W. M'Clintock Channel was entered by way of Franklin Strait, oceanographic stations were occupied and a line of soundings run North to Russell Island, completing the circumnavigation of Prince of Wales Island.

The Gulf of Boothia was entered by way of Bellot Strait and work continued in open water down to Committee Bay. Heavy ice conditions were encountered at the western entrance of Fury and Hecla Strait where a rendezvous was made with C.H.S. "BAFFIN". A passage was forced through the ice, the "MACDONALD" losing two propellers in the process, and both ships entered Foxe Basin.

This completed the hydrographic part of the programme, further oceanographic observations were made in Foxe Basin, and phase c) of the programme was completed without incident.

Summary .:

The following table summarizes the work accomplished.

|                                         |      |
|-----------------------------------------|------|
| Stations at. which serial data obtained | 170  |
| Bathythermograph observations           | 218  |
| Total mileage                           | 9595 |
| Miles of track - bathymetry             | 4025 |

The stations occupied in Canadian Archipelago waters is illustrated in the accompanying diagram.

Conclusion:

Despite the fact that the behaviour of the Archipelago waters have to be inferred from one summer observation a year, the data obtained from these exploratory cruises is providing sufficient information for a subsequent assessment of the mechanics of the system as a whole, with a view to planning a detailed study of a particular area by a winter season field party engaged in through-ice observations.



DEEP OCEAN CIRCULATION

C. R. MANN

In 1961 preparations were made for a study of the circulation and mixing in the deep waters to the east of Nova Scotia and southeast of Newfoundland. It was decided that an extensive oceanographic survey from Nova Scotia to the Azores should be undertaken since existing oceanographic data from the area was not adequate for detailed studies.

Part of this survey was completed in 1962. In February and March CNAV SACKVILLE and CHS BAFFIN made temperature, salinity and oxygen measurements over the slope water area from Nova Scotia to the southern tip of the Grand Banks. During the same cruise the BAFFIN obtained some information southeast of the Grand Banks, but was prevented from carrying out any extensive work by bad weather. In July, a second cruise was made with CNAV SACKVILLE to the slope water area.. During this cruise, measurements of water movements were made with the GEK and with Parachute Drogues set to depths up to 800 meters.

Much of the data gathered this year has been reduced and is under study. Two features of interest are the occurrence of a considerable body of Central Atlantic. water north of the Gulf Stream at depths greater than 250 meters and a body of fresher water at the same depths close to

the Continental Shelf. This fresher water is believed to be the results of mixing with the Labrador Current along the southwest edge of the Grand Banks, the mixed water flowing west along the edge of the Shelf.

Reduction of the data collected to date should be completed in early 1963. It is also planned to continue the work to the east of the Grand Banks in 1963, thus completing the preliminary field work and providing data over the area from Nova Scotia to the Azores.

The location of the work is shown in two accompanying diagrams.

AIR-SEA INTERACTION STUDIES L.A.E. DOE

The work to date has been almost entirely instrumentation concerned with the development of a three-component anemometer for the measurement of vertical transports in the atmosphere, This was done very largely at Woods Hole Oceanographic Institution by personnel of the Bedford Institute before the present laboratory in Dartmouth was opened. Testing has been essentially completed, and the gear is now being modified and packaged for use in the field.

Preliminary field tests were made on a beach on Cape Cod in December using recording equipment borrowed from Woods Hole Institution, The record of x, y and z components of wind velocity were then digitized by eye and the data were sent to New York University where spectra and cospectra were computed. Complete analysis of the results has not been made at the time of writing, but preliminary results seem to indicate that the instrument works well and can extend the range of useful results significantly beyond those previously obtained in studies of this type.

Work has been started on a system of telemetry to enable recording on shore or on board ship of data being observed on a platform *or* float several miles away. Work has also been started on modified versions of the anemometer

with a view to producing a system which is as simple and as easy to handle as possible. The design of suitable mountings for work over water is to be undertaken shortly, so that within a few months it is expected that a program of the measurement of the wind stress on the sea surface should be well underway. Instrumentation for the measurements of heat and water vapour flux over the sea surface will follow as soon as time and resources permit.

A PRELIMINARY INVESTIGATION  
OF THE HEAT BUDGET IN THE  
GULF OF ST. LAWRENCE

J. A. COOMBS

The study of sea temperature and, heat content, and their fluctuation with space and time, is an important subject in any locality, In the Gulf of St. Lawrence such studies are particularly important because of the formation and growth of sea ice in the area,

Prior to 1940 most of the heat budget studies were directed towards the determination of the annual evaporation in different latitudes in order to, examine the general water budget of the atmosphere. An increasing number of such studies have been made since that date, particularly in the last ten years. The majority of these recent investigations have dealt with the problem of the determination of the heat budget for specific regions or localities.

An attempt has been made to determine the principal features of the energy exchange at the air-sea boundary and of the heat budget of the water in the Gulf of St, Lawrence for the period from November 15, 1961 to February 18, 1962. The study has been limited to the above period because the attempt here is to correlate computed heat losses with oceanographic observations made in mid-November 1961 and mid-February 1962. The lack of adequate observations in the area precludes the possibility of determining the heat budget with any assurance over long periods

of time.

Several different empirical formulae, obtained for other localities, have been used for some of the heat loss calculations. The difference in the results provides some measure of the possible errors that can be ascribed to them. The assumptions involved in the use of the formulae are discussed to a considerable extent in order that a better appreciation may be attained of the problems encountered with heat budget studies for the Gulf of St. Lawrence,

A more detailed account is available in Bedford Institute Report B.I.O. 62-1.

CHEMISTRY SERVICE

A. R. COOTE

During the period since July 1962, two chemical laboratories have been set up at the Institute. One of these is being used for physical chemical and development of analytical techniques, while the other is used for salinity determinations and the preparation of solutions.

We are well equipped to carry out routine chemical analysis of seawater, as well as to develop analytical techniques for use at sea. A chemical training program is to start February 15, 1963. During this program, personnel will be made familiar with analytical techniques that will be used during the ICNAF cruise.

The salinity laboratory has been equipped to determine salinity by the Knudsen volumetric titration and by conductivity measurement. One of our two N.I.O. salinometers has been in almost continuous use since November. Three thousand salinities have been determined on this machine so far. The other has been completely stripped, cleaned, and repaired where necessary. It should be running late in January. It is expected to have the Auto-Lab salinometer ready for use at sea for the spring cruises of the "BAFFIN".

WAVE RECORDING

R, L. G. GILBERT

Research had been carried out in 1961 on an accelerometer which gave a pulse frequency proportional to the applied acceleration. Work continued in 1962 on electronic circuits to convert the accelerations measured to displacement-of the accelerometer, and the system was tested by mounting the accelerometer on the end of a long balance beam; the natural period of the beam could be varied from 3 secs. to 20 secs., and the amplitude of motion from 0 to 8 ft. peak to peak. Curious results were noted when the accelerometer was moved in a single cycle of a sine wave, and as a result errors were found in the usually accepted methods of integration of an accelerometer output to give displacement. The electronic circuits were changed so that accelerations were converted to wave velocities, which could be analyzed to find the energy spectrum in the wave-train.

Experiments and calculations were made to find the radio power needed to transmit accelerometer information over a sea-path of 10 miles, allowing for 30 ft, high waves; as no suitable commercial transmitters could be found, a transistorized, crystal controlled, pulse-modulated transmitter was designed and a number built. The most suitable receiver which could be found was modified to suit the special requirements, and four sets of equipment were built for



the receiving stations, including time switches, tape recorders, etc. Six sets of accelerometers, floats, radio transmitters and cables were built, the floats being designed to be moored to large buoys which were laid by the Department of Transport. The equipment was calibrated by swinging each accelerometer on the balance beam.

Installations were made at Cape North, Bird Rocks, and Amherst Island. In each case, the accelerometer float was moored to a D.O.T. buoy, about 10 miles from shore, and the receiving equipment was installed in a lighthouse. Trouble was experienced with the mooring between the D.O.T. float and the accelerometer; two floats were lost because of failures in mooring shackles, one was lost with no explicable cause, and one was crushed and destroyed. The mooring cables had a very strong tendency to tangle with the ground moorings of the D.O.T. buoy. Otherwise, the system worked well and records were obtained for periods of several weeks at a time. Analysis of the records has not yet been attempted, owing to the cessation of the Ottawa wave-hindcasting programme, but the Department of Oceanography of New York University has offered to analyze the data. Experiments are in progress to try to improve the mooring and it is anticipated that when they are successful, the recording system

should be satisfactory in all respects. It should be noted that the accelerometer float is cheap enough and small enough to be expendable, so that wave measurements could be made at sea by launching a float from a ship and recording while the float is still within radio range. A description of the equipment is being prepared.

A second type of wave-recorder, consisting of an elastic rope fastened at the lower end to a drogue and at the upper end to a recorder which indicates the tension in the elastic, was found to be unsatisfactory when moored, although it might be usable as a free-floating device.

4) TECHNICAL SURVEYS-SUMMARIES:

ENVIRONMENTAL SERVICE      W. B. BAILEY

The East Coast Working Party on Oceanographic Services for Defence was set up in September 1960, to study, develop and recommend methods of meeting Maritime Warfare requirements in oceanography. The Working Party comprises representatives of the R.C.N. and R.C.A.F., under chairmanship of an oceanographer from the Department of Mines and Technical Surveys, and is under the administrative control of Flag Officer Atlantic Coast. The technician staff of four is: presently provided by the R.C.N. and includes one Petty Officer assigned for duties as Port Meteorological and Oceanographic Inspector

The synoptic processing carried out during 1962 by the East Coast Working Party has been:

- The collection, plotting and analysis of daily sea surface temperature observations for the Atlantic north of 30°N. and west of 35°W.
- Plotting and analyzing of 5-day composite sea surface temperature charts. (These charts are transmitted by radio facsimile broadcast on Mondays, Wednesdays and Fridays).
- Plotting and card filing of all BT's received daily by radio.
- Plotting and analyzing of 5-day composite, chart of significant bathy features layer depth and vertex depth.

- Plotting of ART observations obtained during trial and evaluation flights,

During 1962, efforts have been made to improve quantity of data available; to improve the quality of observations; to improve communications; to establish the most suitable format for processed data; and in general, to investigate the organization and methods required to process the synoptic input to meet the operational requirement.

It is planned during 1963 to put an increased research effort on several aspects of the environmental service, with the aim of improving the present synopses, and of exploring the possibility of forecasts useful to research, fisheries and maritime defence.

TIDAL CURRENT SURVEYS            D. DOBSON

During the first three months of the year, a general test and adjustment was carried out on all the current recorders on hand, followed by time checks and bench tests. With only two men, these latter take much more time to complete as the physical work involved with the larger instruments is considerable.

Before the sealing fleet left for the season, each vessel was visited and Master and Officers instructed on keeping a drift log when stopped in ice. This is the third year these logs have been issued, completed copies returned are about one third of the total number. Mr. Markham of Ice Central has been able to use them for completion of ice movement patterns.

After a meeting of the Gulf Committee and proposals for programme to correlate current survey and oceanographic data, the preparation of moorings and equipment was begun. One of the most time consuming items was to swing all the instruments having magnetic compasses built in, to obtain a curve of deviation for application to data produced, particularly so, as equipment was being moved piecemeal to the Bedford Institute Depot,

NORTH STAR VI came on charter May 15; fitting out and loading of equipment continued until the end of the month. On June 5, the current survey began with mooring

of equipment at stations on a line from English Point Gaspe to South West Point Anticosti. Observations at these stations continued until September 20, but were not continuous.

Positions of stations and depths observed were as follows:

|    |    |       |    |       |     |     |      |
|----|----|-------|----|-------|-----|-----|------|
| 1A | 48 | 57.6N | 64 | 17.2W | 13M |     |      |
| 1  | 48 | 58.1N | 64 | 14.8W | 13M | 85M |      |
| 2  | 49 | 02.0N | 64 | 10.5W | 13M | 85M | 225M |

For a final period of 5 days at this station, there were nine instruments at depths of 5, 13, 25, 85, 125, 175, 225 and 306 meters.

|   |    |       |    |       |     |     |      |
|---|----|-------|----|-------|-----|-----|------|
| 3 | 47 | 06.8N | 64 | 03.4W | 13M | 85M | 225M |
| 4 | 49 | 14.0N | 63 | 15.5W | 13M | 85M | 225M |
| 5 | 49 | 21.0N | 63 | 42.2W | 13M | 85M | 225M |

Due to trouble with batteries in some of the recorders, they had to be serviced at much shorter intervals than the normal fifteen day period. This resulted in more overtime than anticipated for the ship's crew.

The initial stages of data processing were done on board and results for final analysis forwarded to Ottawa.

One of the major problems of the operation was the poor manoeuvring qualities of the ship, calling for a more cautious approach. Though no direct damage or injury resulted from this, the risks involved were unnecessarily

high. Large numbers of fishing vessels in the area contributed to the loss of instruments; on occasion we found them happily fishing while their boats were secured to the marker buoys. Some of these which broke adrift, were returned by fishermen, as were two buoyant instruments.

Final number of analyses as follows:

| <u>Station</u>            |     | <u>Depths</u> |              |
|---------------------------|-----|---------------|--------------|
|                           | 12  | <u>85</u>     | <u>2 2 5</u> |
| 1A                        | 20  | -             | -            |
| 1                         | 80  | 24            | -            |
| 2                         | 101 | 58            | 58           |
| 3                         | 49  | 15            | 36           |
| 4                         | 33  | 27            | 35           |
| 5                         | 40  | 28            | 46           |
| Harmonic analyses 29 days | 3   | 1             | 1            |
| Harmonic analyses 15 days | 9   | 9             | 4            |

Oceanographic observations for temperature and salinity were taken along the same line on which current recorders were moored. Each set of observations consisted of four crossings from S to N with 1-¼ tidal cycles between the starting time in each case, messenger lines at the 'same intervals for each run of any group. The first series was done in conjunction with SACKVILLE, two runs by each ship with 1/2 tidal cycle between starting times, G.E.K. was used; during two of the return crossings, and in addition



a one mile square pattern was run round each of the positions where there was a moored current recorder at a depth of 13M.

From the temperature salinity observation, it is hoped some correlation between physical current measurement and mass transport calculation may be made, and from the G.E.K. some evidence of its efficiency or otherwise in tidal areas.

A ten-day period in August was devoted to gravimetric observations from the ship. These covered an area roughly parallel to the St. Lawrence trench and to the north coast of P.E.I. During this time, Mr. Goodacre of the Dominion Observatory was in charge of the party, tidal staff in temporary office space in Gaspé, P.Q.

Seasonal tide gauges were installed at St. Anne des Monts, P.Q. Fox River, P.Q., Thunder River, P.Q. and S.W. Point Anticosti by the ship party and at Parrsboro, N.S. and Meteghan, N.S. by a shore party. Gauges at Thunder River and Anticosti were twice damaged by storms and repaired, a 29 day analysis may be available from them, and certainly two or more from the others. Fox River, Gaspé and St. Anne des Monts were tied in to geodetic bench marks. Storm surge gauges, ten in all, around the Gulf area were serviced by ship or shore party during the charter period. In most cases, corrugated steel stilling

wells were installed to replace wooden ones which deteriorate rapidly. Where propane gas is used for winter heating, the possibility of electrical hook-up was investigated and gauge attendants requested to inform us if power lines were installed anywhere in the immediate vicinity.

Early October saw the NORTH STAR off charter and equipment being cleaned up for display during the opening of the Bedford Institute, after which the workshop space was set up and checks and overhauls begun on equipment which had given trouble in the field. The Snodgrass current meters were returned to the manufacturer for correction of defects, and the nickel cadmium batteries put in for complete overhaul in the B.I.O. shops.

Again this winter, the larger part of the tidal data analysis will be done in Ottawa, but a fair amount of tide gauge and film data has been sent here for reading and checking.

HYDROGRAPHIC SURVEYS      G . W . L A C R O I X

During 1962, the Regional Hydrographer was responsible for the following survey establishments :

C.H.S. "MAXWELL"

M/V "ARCTIC SEALER"

C.H.L. "ANDERSON"

C.H.L. "EIDER"

Eastern Arctic Patrol

The operations of the Tidal Chartered Ship, M/V "NORTH STAR VI" also came under this office for administrative support and direction.

As in former years, the survey operations of the ships "BAFFIN", "KAPUSKASING" and "ACADIA" were directed and controlled from the Dominion Hydrographer's Office and the Field Officers concerned reported to him.

In due course, it is presumed that the technical aspects of all hydrographic operations in this region will come under the Regional Hydrographer, and that all field officers will report to this office in the first instance as seems necessary and logical.

For the reason mentioned, the following summary of work concerns the establishments who reported to the Regional Office. The following summarizes the statistical information resulting from field work performed in 1962.

|                                                 | <u>Max-<br/>well</u> | <u>Arctic<br/>Sealer</u> | <u>Ander-<br/>son</u> | <u>Eider</u> | <u>Eastern<br/>Arctic<br/>Patrol,</u> | <u>Tidal</u> | <u>Total</u> |
|-------------------------------------------------|----------------------|--------------------------|-----------------------|--------------|---------------------------------------|--------------|--------------|
| Nautical miles<br>sounded                       | 1042                 | 2152                     | 854                   | 570          | 2767                                  | -            | 7 3 8 5      |
| Kilometers<br>sounded                           | 1907                 | 3938                     | 1563                  | 1043         | 5064                                  | -            | 1 3 , 5 1 5  |
| Ship track<br>soundings<br>( nautical<br>miles) |                      | 1039                     |                       |              | 3730                                  | -            | 4769         |
| Ship track<br>soundings<br>(km)                 |                      | 1901                     |                       |              | 6826                                  | -            | 8727         |
| Area surveyed<br>(sq. nautical<br>miles)        | 115                  | 182                      | 164                   | 11           | 1032                                  | -            | 1504         |
| Area surveyed<br>(sq. km.)                      | 384                  | 608                      | 548                   | 37           | 3447                                  | -            | 5024         |
| Area triangu-<br>lated (sq.<br>nautical mi.)    | 110                  | 156                      | 2                     | 11           | 4                                     | -            | 283          |
| Area triangu-<br>lated ( sq.<br>km.)            | 367                  | 521                      | 7                     | 37           | 13                                    | -            | 945          |
| Shoals<br>examined                              | 1                    | 74                       | 313                   | 329          | 1                                     | -            | 718          |
| Coastlining<br>(naut.mi,)                       | 15                   |                          | 3                     | 3            | 124                                   | -            | 145          |
| Coast lining<br>(km.)                           | 27                   |                          | 5                     | 5            | 227                                   | -            | 264          |
| Triangulation<br>stations<br>established        | 34                   | 88                       | 28                    | 87           | 10                                    | -            | 247          |
| Stations<br>monumented                          | 24                   | 23                       | 15                    | 6            | 5                                     | -            | 73           |

|                                      | <u>Max-<br/>well</u> | <u>Arctic<br/>Sealer</u> | <u>Ander-<br/>son</u> | <u>Eider</u> | <u>Eastern<br/>Arctic<br/>Patrol</u> | <u>Tidal, Total</u> |     |
|--------------------------------------|----------------------|--------------------------|-----------------------|--------------|--------------------------------------|---------------------|-----|
| Secondary<br>stations<br>established | 38                   | 9                        | 58                    | 27           | 2                                    | -                   | 134 |
| Icebergs<br>tracked                  | -                    | -                        | -                     | -            | 6                                    | -                   | 6   |
| Tide gauges<br>established           | 3                    | 6                        | 2                     | 4            | 1                                    | 6                   | 22  |
| Bench marks<br>established           | 6                    | 10                       | -                     | 3            | 3                                    | 18                  | 40  |
| Current survey<br>stations           |                      | -                        | -                     | -            | 6                                    | 6                   | 12  |
| Harmonic<br>analysis,<br>29 day      | -                    | -                        | -                     | -            | -                                    | 5                   | 5   |
| Harmonic<br>analyses,<br>15 day      | -                    | -                        | -                     | -            | -                                    | 22                  | 22  |
| Gravimetric<br>observations          | -                    | -                        | -                     | -            | -                                    | 10 day period       |     |

The following list indicates the completed and incompletd projects by establishments.

| <u>Establishment</u> | <u>Completed<br/>Plans</u>             | <u>Completed<br/>Field Sheets</u> | <u>Incompleted<br/>Projects</u> |
|----------------------|----------------------------------------|-----------------------------------|---------------------------------|
| Maxwell              | 1) N.S. Pulp Co.<br>Madden Pt., N.S.   |                                   | 4) 3 sheets - Baie<br>Comeau    |
|                      | 2) B.A. Oil Wharf<br>Peebles Pt., N.S. |                                   | 5) Plan, Father Pt.             |
|                      | 3) Black Cape Wharf                    |                                   | 6) 1 Plan, Baie Comeau          |

| <u>Establishment</u>  | <u>Completed Plans</u>           | <u>Completed Field Sheets</u>                                                         | <u>Incompleted Projects</u>                              |
|-----------------------|----------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------|
| Arctic Sealer         | 1) Grove Pt.                     | 3) Etagualet Bay ( Lake Melville )                                                    | 7) Port Harrison, P.Q. but chart could now be published. |
|                       | 2) Goose Bay Narrows             | 4) North Belcher Is. (Exploratory Survey)                                             |                                                          |
|                       |                                  | 5) South Belcher Is. (Exploratory Survey)                                             |                                                          |
|                       |                                  | 6) Long Island Sd. (Exploratory Survey)                                               |                                                          |
| Anderson              |                                  | 1) Lunenburg Hbr. (3 sheets)                                                          | 3) Cape Sable Is. to Half Bald Is.                       |
|                       |                                  | 2) Barrington Bay                                                                     |                                                          |
| Eider                 | 1) Hfx. Pulp Co, - Sheet Harbour | 2) Sheet Hbr.                                                                         | 5) Approaches to Sheet Hbr.                              |
|                       |                                  | 3) Beaver Hbr. to Taylor Hd.                                                          | 6) Spry Hbr, 6 Approaches to Mushaboom                   |
|                       |                                  | 4) <u>Note</u> as a result of cleanup work, proposed chart 4283 can now be published. | 7) Beaver Id, to Nichol Id.                              |
|                       |                                  |                                                                                       | 8) Ecum Secum to C. St. Mary                             |
|                       |                                  |                                                                                       | 9) Ship Hbr. C Approach                                  |
| Eastern Arctic Patrol |                                  | 1) Smith Sound (Exploratory Survey)                                                   | 4) Churchill                                             |
|                       |                                  | 2) Cape Dorset                                                                        | 5) Ivugivik                                              |
|                       |                                  | 3) Alexandra Fjord                                                                    |                                                          |

### Inspections

During the season, inspection visits were made to "ANDERSON" and "EIDER" parties and their field work reviewed,. It is considered very useful to make such visits and recommended that each establishment in the region should be visited once annually in future.

### Hi-Fix

The new positioning system which was assigned to "ANDERSON" during the first part of the season, was rather extensively tested in the Cape Sable Island region of Nova Scotia during May and June. The results indicated that this device is a powerful aid for inshore hydrographic work. It was tested only up to 20 miles range, but believed to be capable of much better than this. Evaluation of the results obtained indicate that, at this range, the Hi-Fix will produce results with not more than  $\pm 7\text{-}\frac{1}{2}$  metres extreme error, and that the actual error in most cases is probably closer to  $\pm 2\text{-}\frac{1}{2}$  metres. The results obtained will be written up shortly (LaCroix and Murdock) and submitted.

In July, the Hi-Fix was sent with "LABRADOR" for the work in Smith Sound. The experience here was that, due to polar ice, bad weather and certain faults in the equipment which was not rugged enough for arctic work, very little effective use could be made of the system. It is suggested that this very effective system is largely

wasted when used on exploratory surveys in the far north and that, in most cases at least, more value can be gained by using it for standard surveys in regions where intricate hydrographic surveys are required,



5) AREAS OF OPERATIONS - DIAGRAMS:

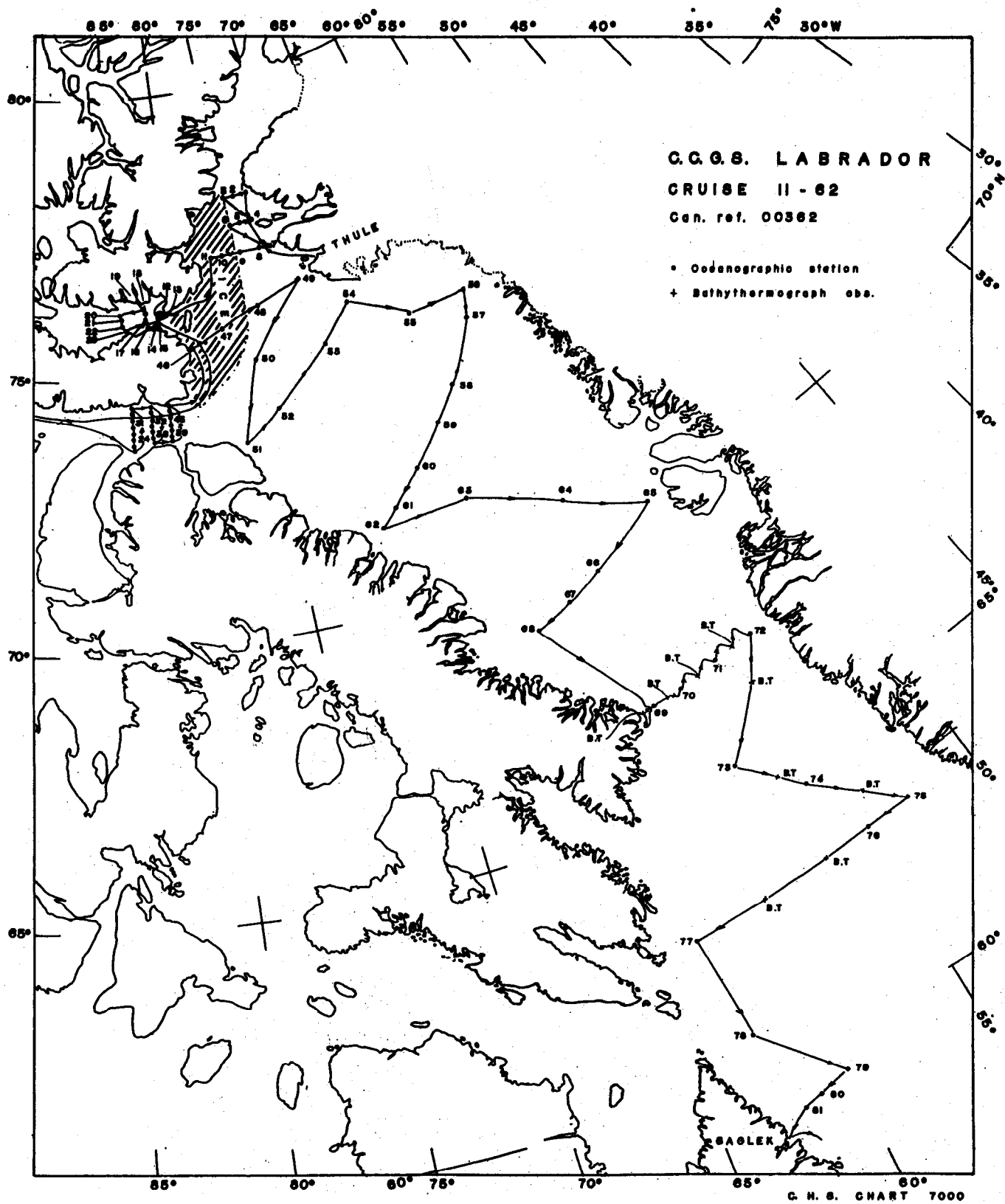


Fig. 1 - Oceanographic Observations - C.C.G.S. "LABRADOR"  
September/October 1962.

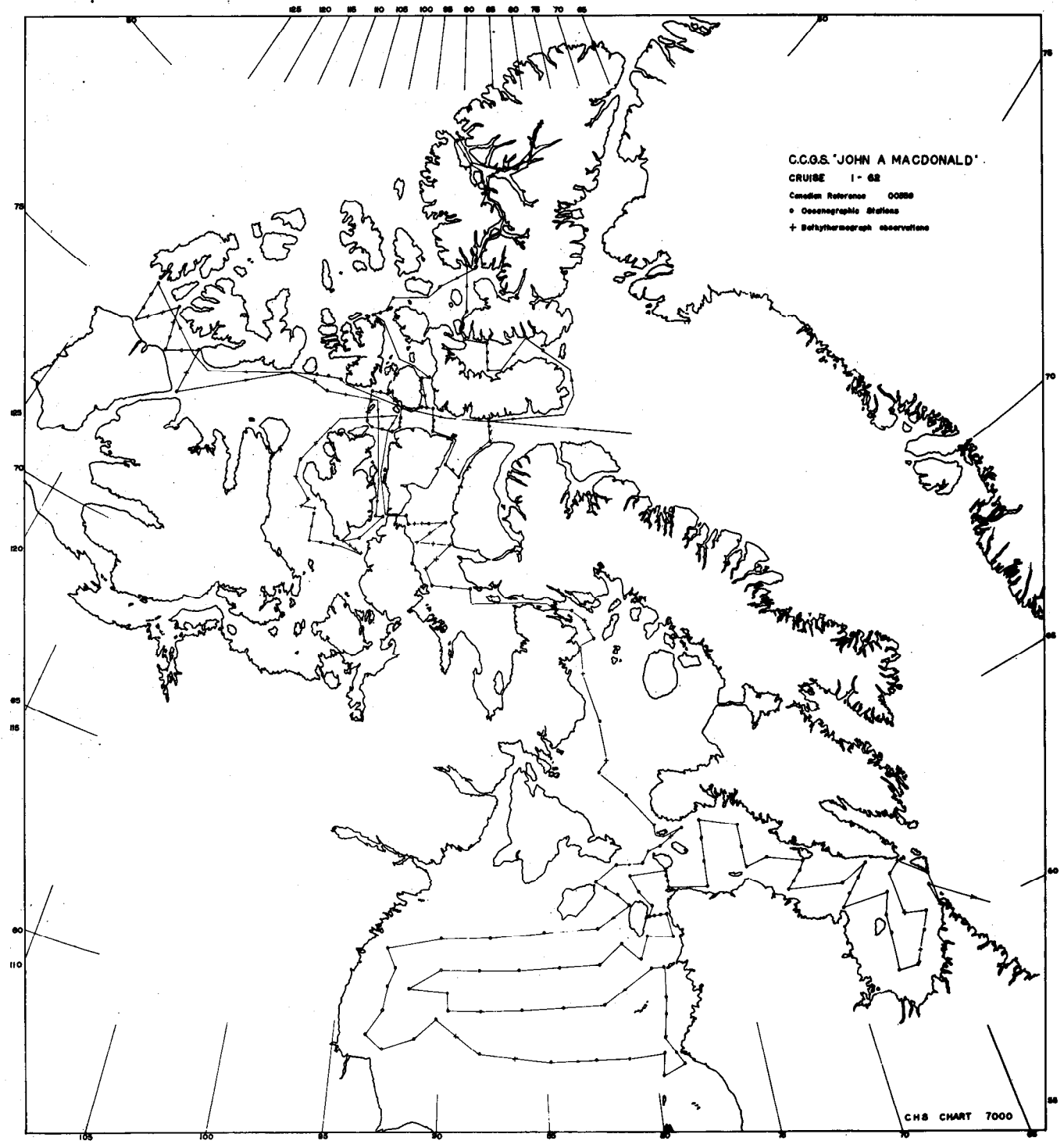


Fig. 2 - Oceanographic Observations - C.C.G.S. "JOHN A. MACDONALD"  
July/October 1962.

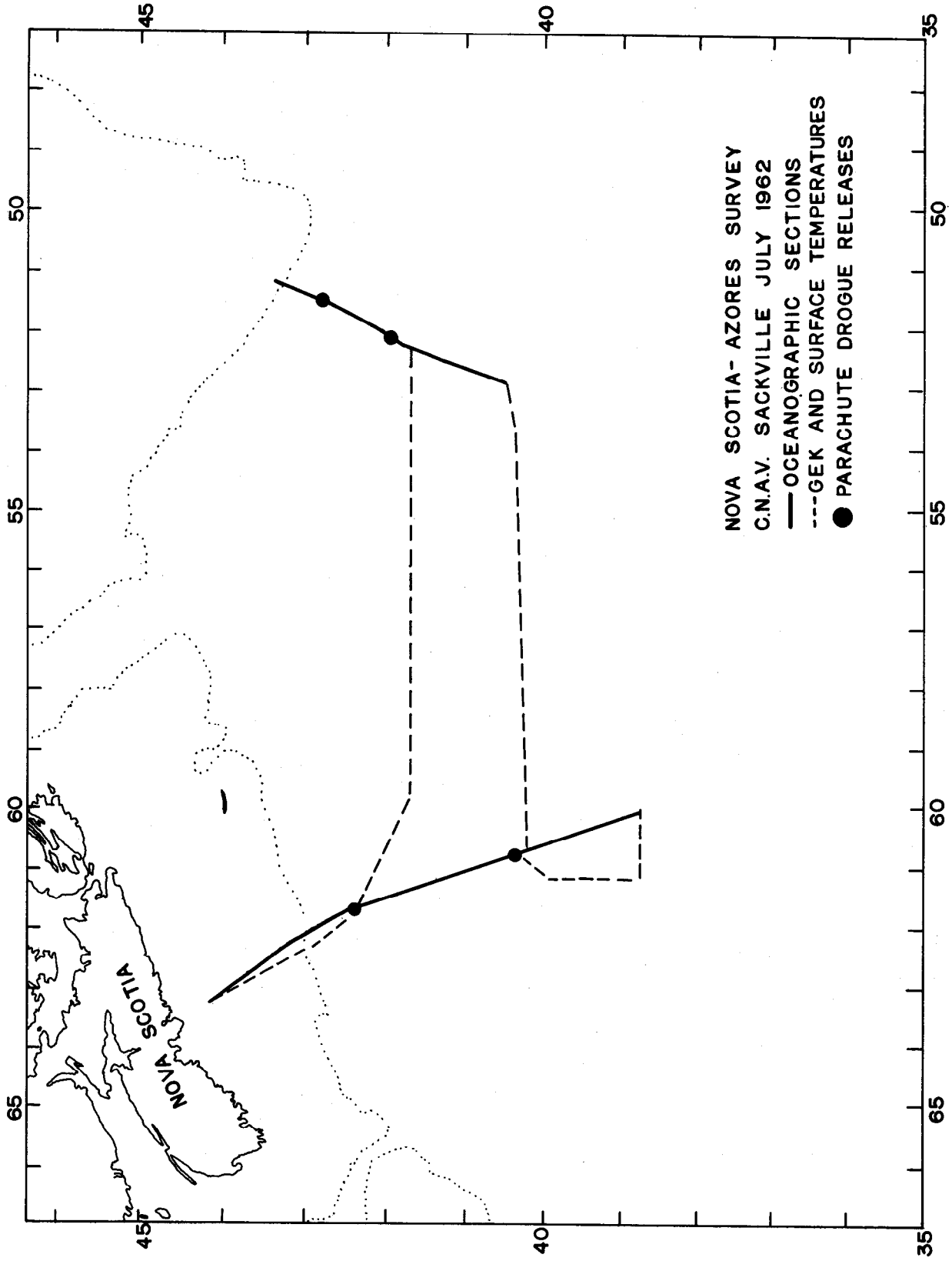


Fig. 3 - Oceanographic Survey - C.N.A.V. "SACKVILLE"  
 July 1962.

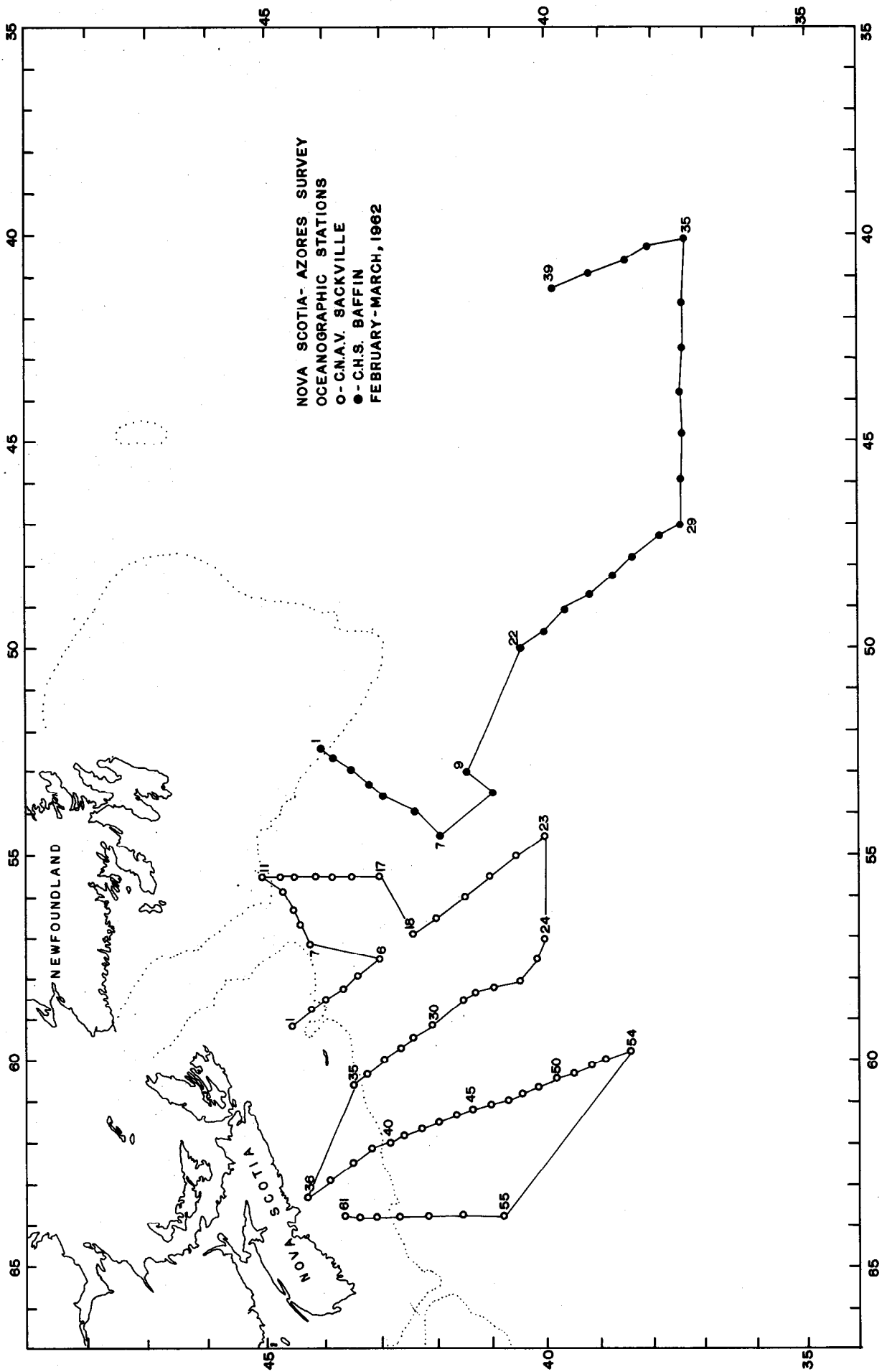


Fig. 4 - Oceanographic Survey - C.H.S. "BAFFIN"  
 February/March 1962.

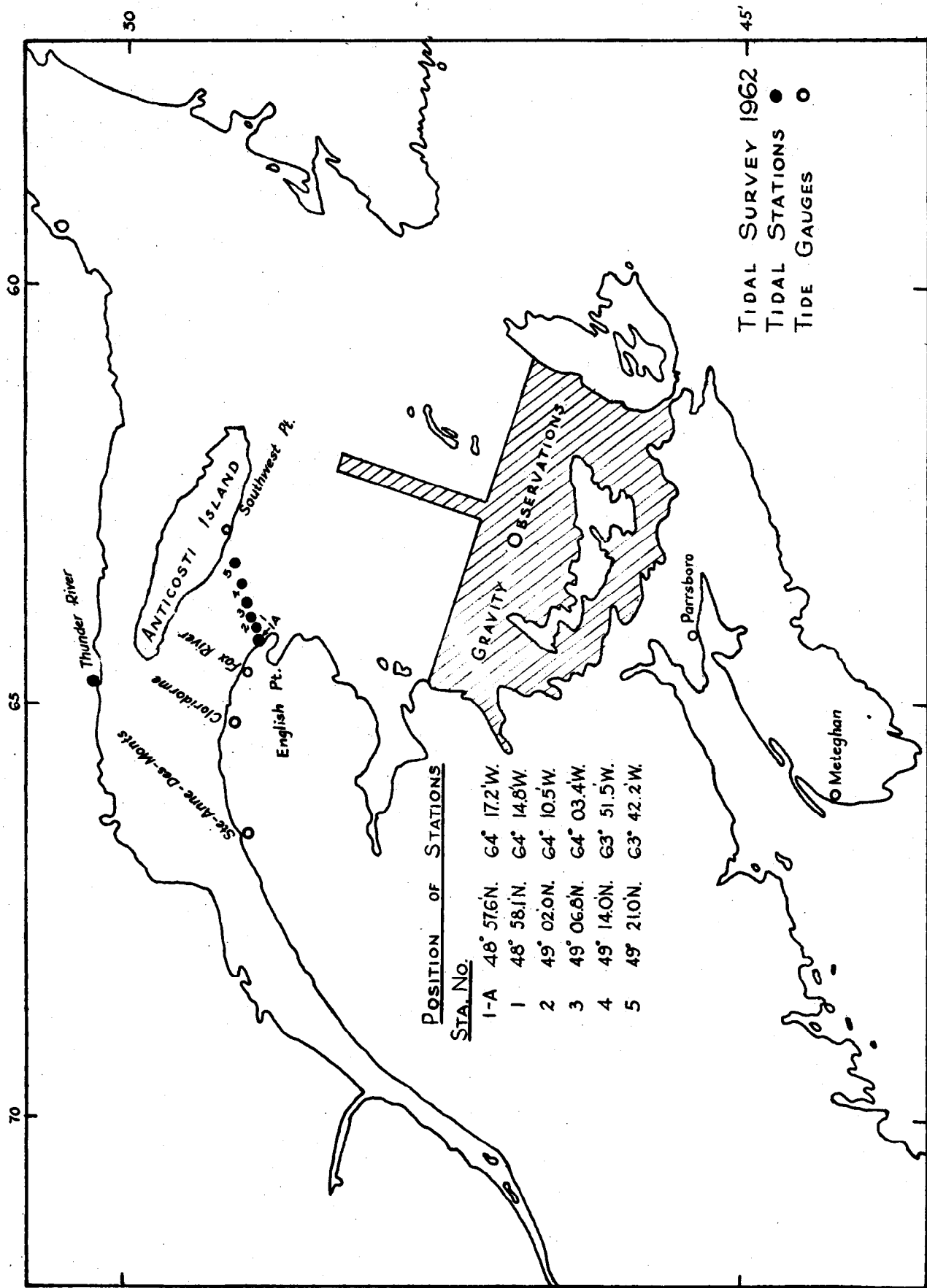


Fig. 5 - Tidal Survey - 1962.

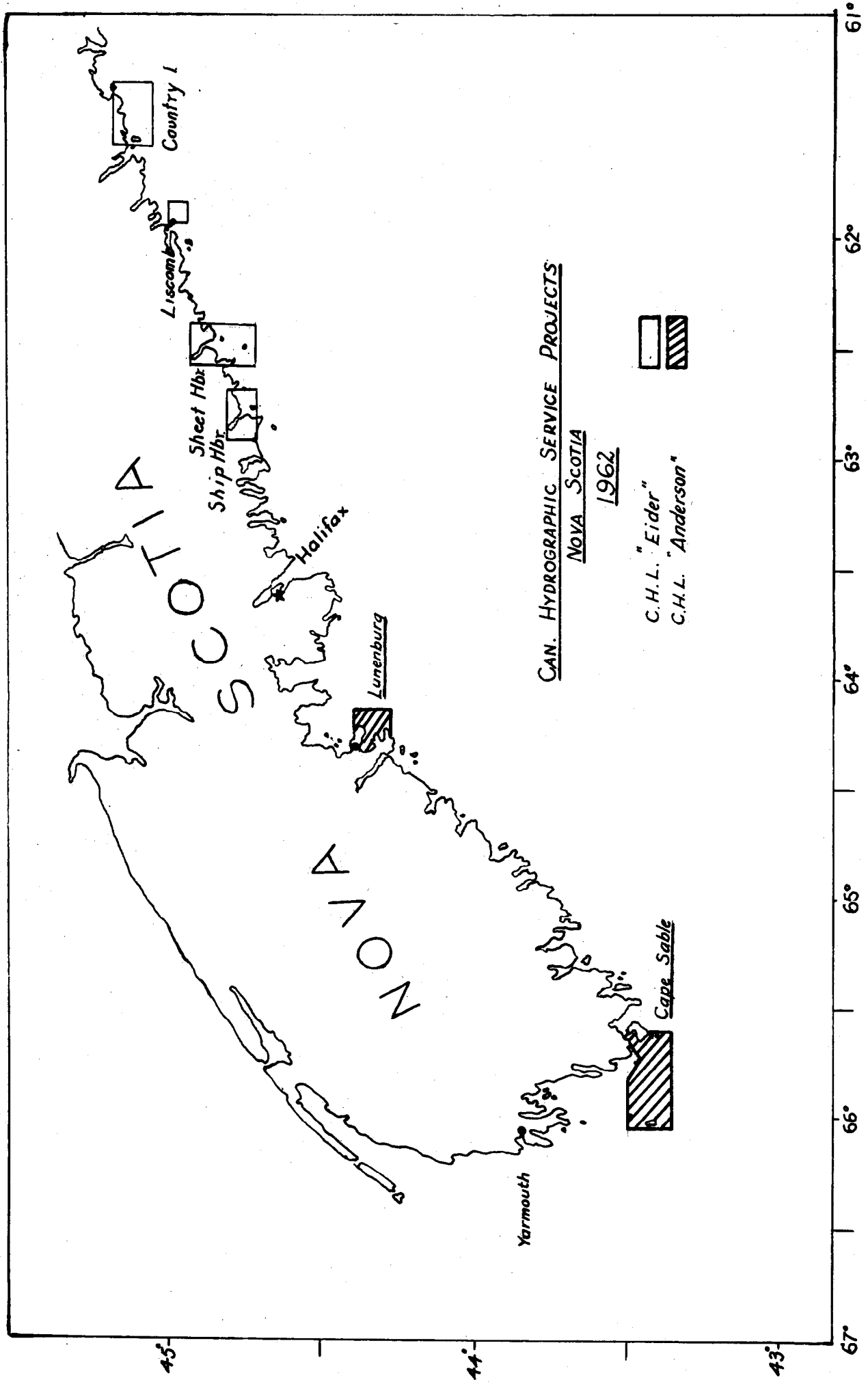


Fig. 6 - Launch Parties Hydrographic Surveys - 1962.

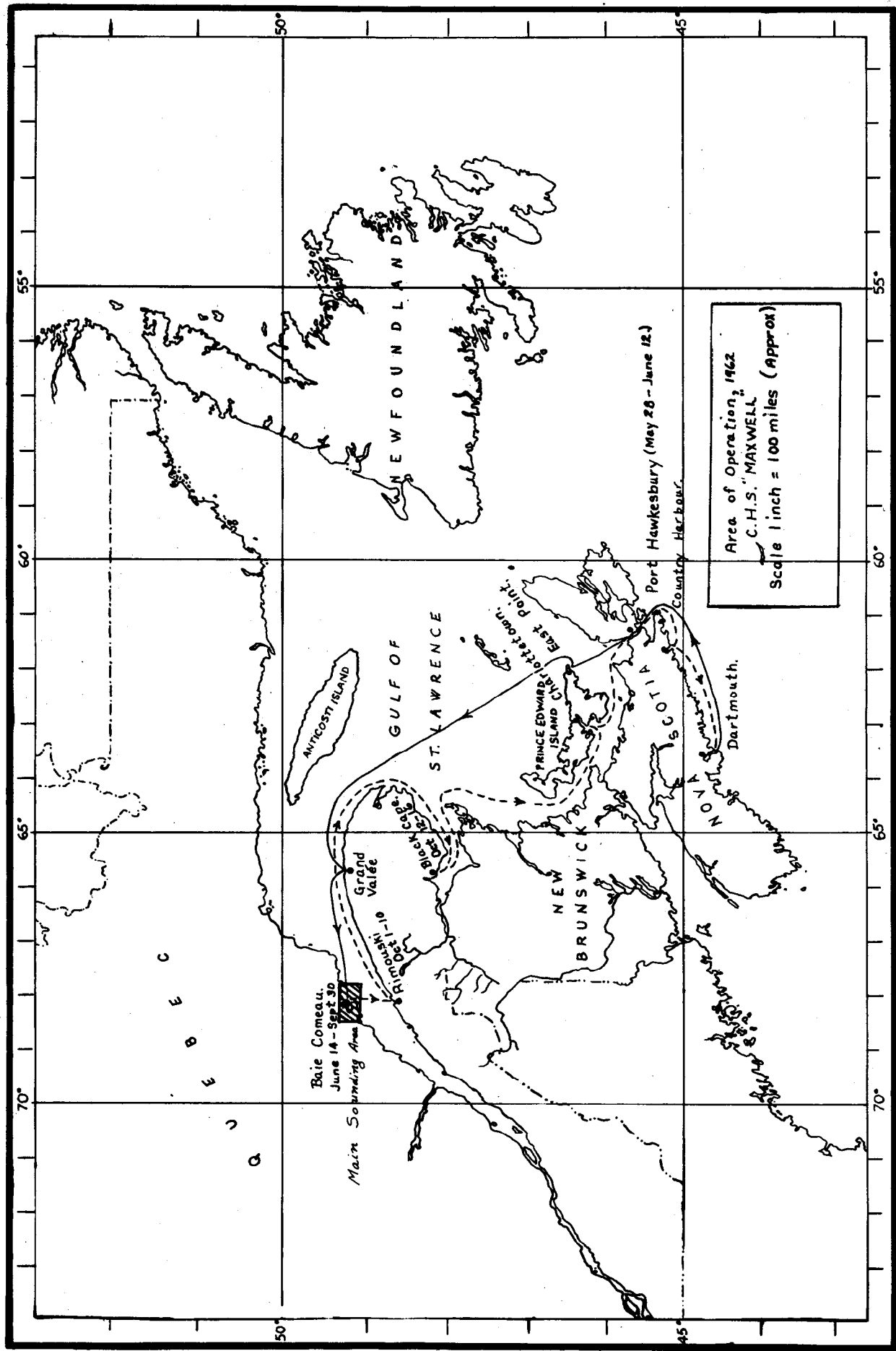


Fig. 7 - Hydrographic Surveys - C.H.S. "MAXWELL" - 1962.





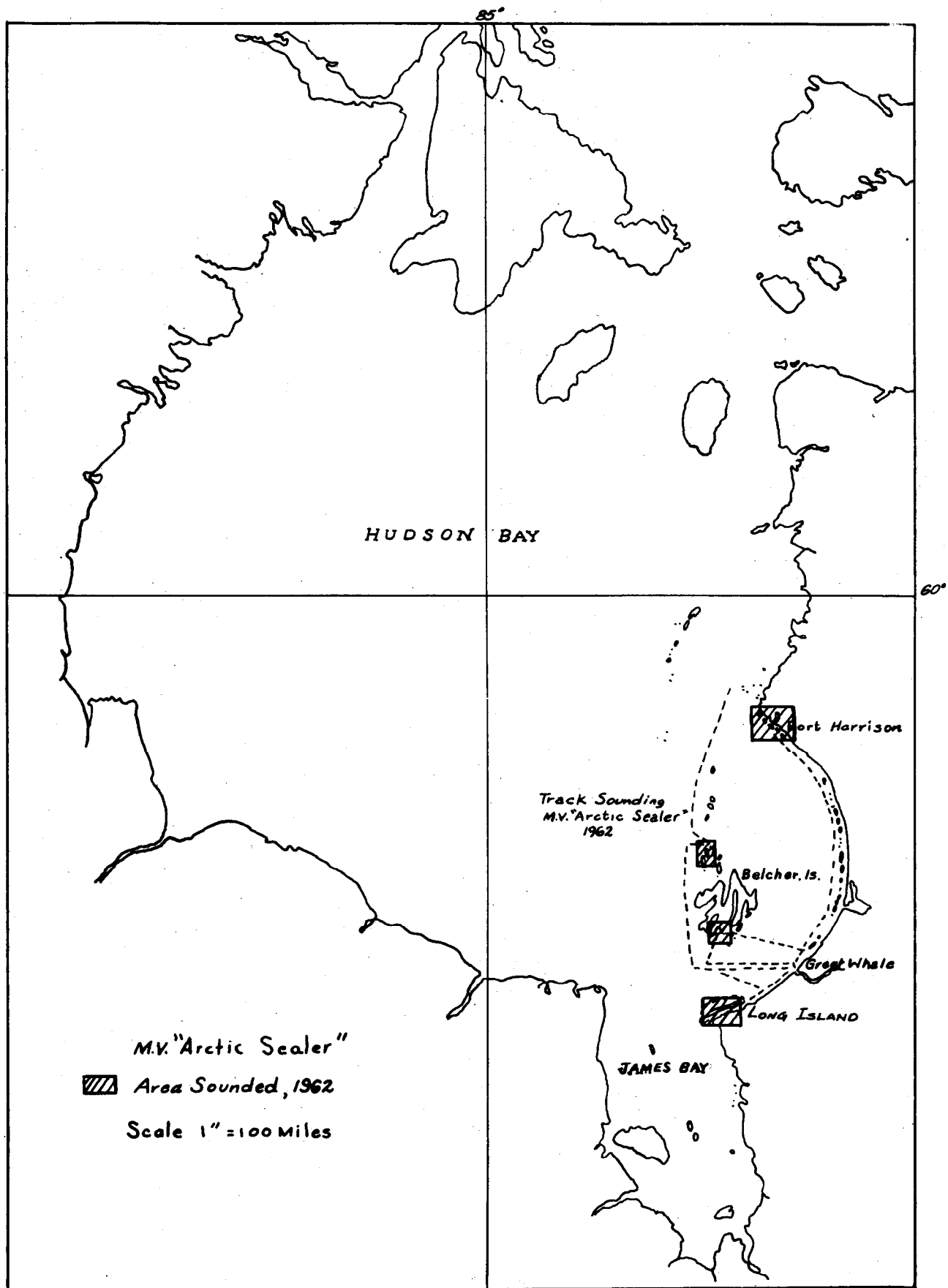


Fig. 9 - Hydrographic Surveys - M.V. "ARCTIC SEALER" - 1962.  
Part II.

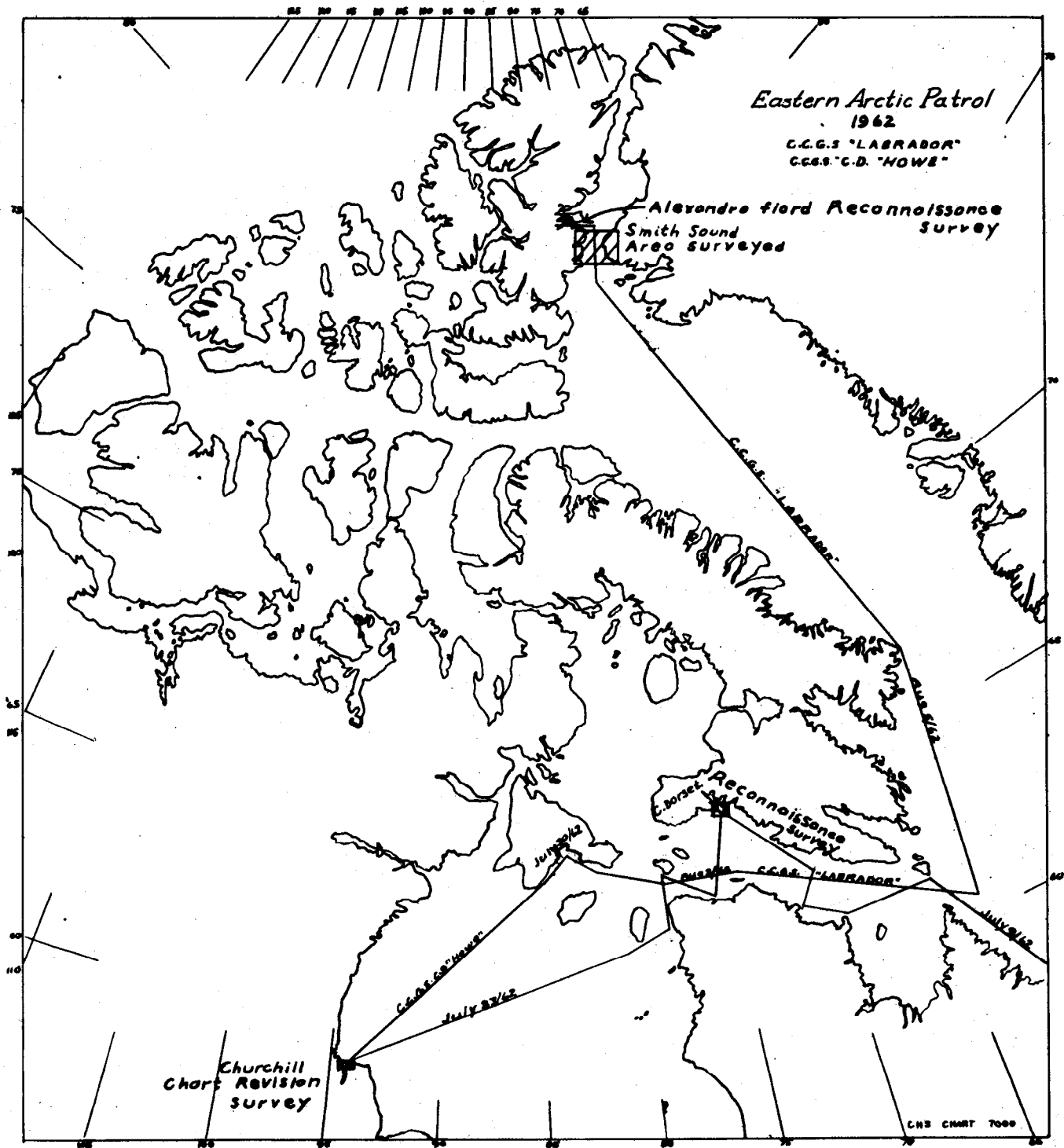


Fig. 10 - Hydrographic Surveys - C.C.G.S. "LABRADOR" and C.C.G.S. "C.D. HOWE" - 1962.

6) DIRECTORY OF PROFESSIONAL AND SENIOR  
TECHNICAL STAFF:

|                  |                                    |                                                                        |
|------------------|------------------------------------|------------------------------------------------------------------------|
| W. N. English    | Director                           | B.A., British Columbia<br>Ph.D., California                            |
| G. W. LaCroix    | Regional Hydrographer              | B.Sc., Saskatchewan                                                    |
| C. R. Mann       | Regional Research<br>Oceanographer | B.Sc., M.Sc., New Zealand<br>Ph.D., British Columbia                   |
| R. L. G. Gilbert | Engineer-in-Charge                 | B.A., M.A., Ph. D., Cambridge                                          |
| J. S. Horam      | Regional Ships'<br>Officer         | Certificate,<br>Eng. 1st Class, U.K., B.O,T.                           |
| S. H. Scott      | Administrative Officer             |                                                                        |
| R. C. Amero      |                                    | Certificate, Land Survey Institute,<br>Provincial Land Surveyor, N. S. |
| W. B. Bailey**   |                                    | B. Sc., Acadia                                                         |
| R. Balfour       |                                    |                                                                        |
| H. R. Blandford  |                                    | Certificate, Master (F.G.)                                             |
| J. Butters       |                                    | Certificate, Master (F.G.)                                             |
| J. B. Cameron    |                                    |                                                                        |
| R, M. Cameron    |                                    |                                                                        |
| A. E. Collin     |                                    | B.A., M.Sc. Western Ontario<br>Ph.D., McGill                           |
| A. R. Coote      |                                    | B.A., British Columbia                                                 |
| J. A. Coombs*    |                                    | B.A.Sc., Toronto                                                       |

|                  |                                                                        |
|------------------|------------------------------------------------------------------------|
| P. L. Corkum     |                                                                        |
| D. Dobson        | Certificate, Master (F.G.)                                             |
| L. A. E. Doe     | B.A., M.A., Toronto                                                    |
| F. L. DeGrasse   |                                                                        |
| S. S. Dunbrack   | Certificate, Land Survey Institute,<br>Provincial Land Surveyor, N.S.  |
| J. A. Elliott    | B.Sc., Saskatchewan                                                    |
| W. D. Forrester* | B.A., Toronto<br>M.Sc., British Columbia                               |
| V. J. Gaudet     | Certificate, Land Survey Institute,<br>Provincial Land Surveyor, N.S.  |
| J. J. G. Godin*  | B.A., College de l'Assomption<br>B.Sc., M.Sc., McGill<br>M.A., Toronto |
| M. A. Hemphill   |                                                                        |
| A. M. Holler     | Certificate, Master (F.G.)                                             |
| A. D. Kenney     |                                                                        |
| C. J. Langford   | Certificate, 1st Mate (F.G.)                                           |
| J. R. N. Lazier* | B.A., Toronto                                                          |
| E. L. Lewis      | B.Sc., M.Sc., Ph.D., London                                            |
| J. G. Martin     | Certificate, Land Survey Institute,<br>Provincial Land Surveyor:, N.S. |
| L, P. Murdock    |                                                                        |
| P. H. McGrath    | B.Sc., M.Sc., Western Ontario                                          |
| G. T. Needler    | B.Sc., M.Sc., British Columbia<br>Ph. D., McGill                       |
| N. S. Oakey      | B.Sc., McGill<br>M.Sc., Saskatchewan                                   |
| I. M. H. Pagden  | B.Sc., Exeter                                                          |

|                  |                                                                       |
|------------------|-----------------------------------------------------------------------|
| J. M. R. Pilote  | Certificate, 1st Mate (F.G.)                                          |
| W. J. Probert    | Certificate, Land Survey Institute;<br>Provincial Land Surveyor, N.S. |
| L. D. Quick      | Certificate, Master (F.G.)                                            |
| C. Quon*         | B.Sc., Alberta                                                        |
| R. F. Reiniger   | B.Sc., Saskatchewan                                                   |
| R. C. Richards   |                                                                       |
| C. K. Ross       | B.Sc., Toronto                                                        |
| H. Sandstrom*    | B.A., M.A., Toronto                                                   |
| A. Smith         | Certificate, Master (F.G.)                                            |
| T. B. Smith      | Certificate, Land Survey Institute,<br>Provincial Land Surveyor, N.S. |
| S. D. Smith      | B. Eng., McGill                                                       |
| D. M. Snelgrove  | Certificate, Master (Coasting)                                        |
| H. B. Sutherland |                                                                       |
| K. O. Westphal   | B.Sc., Wureburg, Germany<br>M.A., Toronto<br>Ph.D., British Columbia  |
| R. K. Williams   |                                                                       |

\* - On Educational Leave

\*\* - Transferred from Atlantic Oceanographic Group, F.R.B.,  
August 1, 1962.

PARTIAL DIRECTORY OF SHIPS OFFICERS

C . H . S . "BAFFIN"

|                |                 |                  |
|----------------|-----------------|------------------|
| Master         | W. N. Kettle    | Master (H.T.)    |
| 1st Officer    | W. J. Vieau     | Master (F.G.)    |
| 2nd Officer    | A. R. Turnbull  | Master (H.T.)    |
| Chief Engineer | M. H. Himmelman | 2nd Class Diesel |
| 2nd Engineer   | W. Buchan       | 2nd Class Diesel |

C . H . S . "KAPUSKASING"

|                |              |                 |
|----------------|--------------|-----------------|
| Master         | W. Thorne    | Master (H.T.)   |
| 1st Officer    | A. Porter    | Master (H.T.)   |
| 2nd Officer    | J. Bourgeois | Master (H.T.)   |
| Chief Engineer | R. Berntsen  | 1st Class Steam |
| 2nd Engineer   | E. G. Clarke | 3rd Class Steam |

C.H.S. "ACADIA"

|                |                 |                            |
|----------------|-----------------|----------------------------|
| Master         | J. W. C. Taylor | Master (H.T.)              |
| 1st Officer    | J. R. Gillis    | 1st Mate (H.T.)            |
| 2nd Officer    | H. J. Martin    | 2nd Mate (F.G.)            |
| Chief Engineer | J. Lavoie       | 3rd Class Steam            |
| 2nd Engineer   | J. W. Baker     | 3rd Class Steam and Diesel |

C.H.S. "MAXWELL"

|                |            |                  |
|----------------|------------|------------------|
| Master         | S. Baggs   | Master (H.T.)    |
| Chief Engineer | E. Bachman | 3rd Class Diesel |